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ORIGINAL ARTICLE

Outcome of Arthroscopic Anterior Cruciate Ligament Reconstruction Knee Joint Using Hamstring Autograft: A Two Years Experience

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ABSTRACT

One of the most common injuries during sports is anterior cruciate ligament (ACL) injury. A number of surgical and rehabilitation techniques have been developed. ACL reconstruction is mainstay of treatment.

Objective: In this study we are evaluating the outcome of ACL surgery.

Design & Setting: Retrospective study

Methodology: Data collection of all cases that underwent primary arthroscopic anterior cruciate ligament reconstruction performed. All patients were operated with same surgical technique using quadrupled hamstring autograft.

Results: There was an overall male predominance (95.3%). Medical meniscal injury was found in 05 (24%) patients. Lateral Meniscus injury was found in 04(19%) patients. Adjustable length CSF device was used in 12 (57%) patients and fixed-loop CSF device in 9 (43%) patients.

Conclusion: At two years, outcome of ACL reconstruction performed by one surgeon using same surgical technique with adjustable CSF device and absorbable tibial screw granted satisfactory clinical results in all patients. Rehabilitation played an important role in return to activities of daily living in all patients at final follow up.

Keywords: Anterior Cruciate Ligament, Arthroscopy, Rehabilitation

INTRODUCTION

Anterior cruciate ligament (ACL) injury ranges from minor sprain to complete tear of the ligament. It is one of the most common sports injury, especially among young athletes. ACL reconstruction is therefore frequently performed orthopaedic procedure[1].Aim of surgery is to restore knee stability and patients return to sports. There is also a reduced risk of further meniscal orchondral damage in an otherwise unstable knee[2].A number of surgical techniques have been developed for the reconstruction of a completely torn or an unstable ligament. Autograft reconstruction is the most common technique and lot of research has been done regarding donor site morbidity and long-term outcomes. Autograft can be harvested from a number of places but two of the most common are quadrupled hamstring (HS) and bone patellar tendon bone (BPTB).[2] Numerous studies have been performed to compare the short and long term outcomes but no conclusive evidence of superiority of one technique over the other could be found[3].

Success of ACL reconstruction is dependent on various factors and lot of research work has been done to improve our understanding of these factors such as graft choice[2], ligament anatomy[4]anatomical placement of graft tunnels[5] and graft fixation techniques.[6,7] Graft fixation should be reliable and rigid. One such recent development is bio-absorbable interference screws which are replacing metal screws but they are associated with their own issues such cyst formation[8] and tunnel widening[9]. Use of osteoconductive materials has reduced the magnitude of problem but not completely resolved it[10]. On the femoral side there is development of cortical suspensory fixation (CSF) devices which are becoming common practice.[7]Adjustable length CSF devices for femur have been designed that can adjust the final length of graft to increase maximum tension intraoperatively.[9, 11]These latest adjustable length femoral devices have ability to minimise the lengthening of graft and they have shown satisfactory graft incorporation at 6 months with minimal tunnel widening[12,19]. One study reported that adjustable-length CSF devices are associated with graft lengthening and this can lead to residual laxity and subsequent failure.[14,15] But many other studies have shown favourable outcomes with the use of adjustable-length CSF devices which can be compared with fixed loop CSF devices.[16-20]

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This study aims to evaluate the outcome of ACL surgery performed by one surgeon in two year period by using both types of devices, fixed loop and adjustable length cortical suspensory fixation (CSF) device.

MATERIALS AND METHODS

Study Design and Setting: Retrospective data collection was done from a tertiary care hospital from the past two years.

Sample Selection: All patients who underwent primary arthroscopic anterior cruciate ligament reconstruction were included. Multi ligament reconstruction, open reconstruction and use of Patellar bone tendon bone graft patients were excluded

Data Collection: All patients provided written informed consent for the use of their data for research purposes. Preoperative and postoperative knee evaluation was done and recorded on a proposed proforma. All patients had instability and functional impairment, confirmed by grade II or more anterior draw test, positive Lachman test and/or pivot-shift test. All patients had cortical suspensory fixation (CSF) device on femoral side and interference screw fixation of graft on Tibial side. A total of 10 patients were excluded because they had concomitant peripheral ligament injuries (n=6) that required additional surgery or opted for patellar bone tendon bone graft (n=4), leaving a study sample of 21 patients.

Surgical Technique: All patients were operated with same surgical technique. Patients were positioned supine with side support at thigh level and foot support in 25 degree knee flexion, under general or spinal anaesthesia. A pneumatic tourniquet was applied at base thigh but not inflated at the beginning. A 3 cm medial tibial incision at the level of fibular neck was made and semi tendinosus and gracilis tendons were extracted using a tendon harvester, made 4 loops, and stitched at the ends using absorbable sutures. This quadrupled hamstring graft was then passed through CSF devices: we used fixed loop CSF device in 10 patients and adjustable-length devices in 11 patients. All fixed-loop devices had loop length of 20mm. Graft was prepared, put in the CSF Device and put aside at this stage.

Next tourniquet was inflated (300 mm Hg) and two standard incisions were made for arthroscopy of knee: antero-lateral forcamera portal and antero-medial for the instruments. First a diagnostic arthroscopy was performed then a single-bundle anatomic technique was applied for ACL reconstruction. With the

knee flexed at 120 degree, ACL foot print was identified and guide wire passed. Then femoral tunnel was drilled from inside-out. For fix-loop CSF device 30mm tunnel and for adjustable-length devices 25 mm tunnel was reamed. Tunnel was always centred on the native ACL foot print and 1 cm anterior to the posterior wall.[21,22] Next tibial tunnel was drilled using tip aimer ACL guide set at 55 degree and at the centre of the remnant ACL footprint. We do not debride tibial remnant of ACL. This helped as an excellent guide and also provided some vascularity to the new graft. The graft was then pulled the tibial tunnel to the femur side under arthroscopic supervision. Fixed-loop devices were flipped and adjustable-length devices were pulled maximally in femoral tunnel before locking by downward pull. At this point graft was held at tibial tunnel by manual tension and knee was taken through 10-15 cycles of full flexion and extension to adjust graft placement and tensioning, and then interference screw was inserted in the tibial tunnel with maximum pull and knee in 25 degree flexion. Anterior draw test was then performed to confirm the knee stability.

Rehabilitation Protocol: Rehabilitation protocol were same for all our patients, with full weight bearing allowed as patient feel comfortable and extension knee brace. Patient was encouraged to start calf stretches, foot exercises and patellar mobilisation on day 1. After three days dressing was changed and patients were taught 0-30 degree range of movement exercises. This was gradually increased over 4 weeks at which point knee brace was removed and patient was allowed to walk without support. Driving, cycling and swimming were allowed after 6 weeks, and jogging after 3 months. Sports were allowed after 6 months.

RESULTS

The final sample of 21 patients comprised 01 woman (4.7%) and 20 (95.3%) men, with average age of 27 years (range, 18-41 years) (Table 1). Mean body mass index (BMI) was 25.5kg/m^2(range, 23-28 kg/m^2). Most of our patients 13(62%) enjoyed recreational sports only, 4 (19%) patients were in competitive sports and 4 (19%) patients had no sporting activities and their injury was traumatic in nature. The mean graft diameter was 8 mm (range, 7-9 mm) (Table 1).

Table 1. Baseline Characteristics

	Frequency n = 21
Gender n(%) Male Female	 20 (95.3%) 01 (4.7%)
Age (in years) Range Mean±SD	 18-41 27±3.1
Side n(%) Right Left	 12 (57%) 09 (43%)
Sports Level n(%) Competitive Recreational None	 04 (19%) 13 (62%) 04 (19%)
Mean Graft Diameter	08 (Range 7-9mm)

We used adjustable length CSF device in 12 (57%) patients and fixed-loop CSF device in 09 (43%) patients. Bio-absorbable screw used as interference device on tibial side in all patients. Quadrupled hamstring autograft was done in all patients.

Looking at the complications 18 (85%) patients had no infection. 03(14%) patients had superficial infection of tibial graft site wound which was treated with daily dressing and two weeks of antibiotics and had full recovery. One patient had deep infection on tibia which was treated with debridement and VAC dressing with 6 weeks of antibiotics. Luckily no graft infection was reported in any patients and all went on to full recovery. Infection rate was 19%. Poor theatre maintenance, non-adherence to infection prevention protocols and sharing of theatre with general surgery on alternate days was considered the reasons for these infections.

Regarding instability, one (4.7%) patients had complaint of residual instability. This patient refused further intervention with missed LCL injury and so he was managed with physiotherapy. One (4.7%) patient continued to have pain during sports. He was fast bowler and his arthroscopy already revealed cartilage thinning and arthritic changes so he was advised to consider changing his sports. His knee was stable otherwise. None of the patients had residual stiffness. Range of movement was 0-120 degree recorded in all patients.

Figure-01. Rate of Infection

Table 2. Frequency of Complications

	Frequency	Outcome
Residual instability	02	Managed with physiotherapy and improved over time
Chronic pain	01	Advised to change sports activity

Table 3 shows associated injuries that were found while performing arthroscopic anterior cruciate ligament reconstruction of knee joint. Out of total 21, Medical meniscal injury was found in 05 (24%) patients. Lateral Meniscus injury was present in 04 (19%) and 02 (9.5%) patients had bilateral meniscal tears. All meniscal injuries were debrided to a stable edge. Repair of meniscus was not attempted in any patient because no patient opted for repair and its associated risks during the preoperative discussion. 01 patient (4.7%) had osteochondral defect over the medial femoral condyle in non weight bearing area. Defect was debrided and micro fracture done. Patient recovered well. 01 patient (4.7%) had grade II medial collateral (MCL) injury which was treated conservatively. 01 patient (4.7%) had Lateral Collateral ligament (LCL) injury. No patient in our sample had Posterior cruciate ligament injury.

Table 3. Associated Injuries with consequent management & Outcome

	Frequency n=14	Management	Outcome
Medial Meniscal Injury	05	Debridement	Stable
Lateral Meniscal Injury	04	Debridement	Stable
Bilateral Meniscal Injury	02	Debridement	Stable
Osteochondral Defect	01	Micro fracture done	Asymptomatic at 1 year follow up
MCL Injury	01	Conservative	Stable at 2 year follow up
LCL Injury	01	Missed	Under follow up

At final follow up, all patients had full range of movement, no graft failures, no infection and all were able to return to their pre-injury level of activities except one patient.

DISCUSSION

Graft fixation and surgical technique are two most important factors in successful outcome of ACL reconstruction [6, 23, 24]. The purpose of this study was to look at the outcome of ACL reconstruction performed in two years by one surgeon. Same technique was

applied in all cases but there were variations in the theatre setup. We used quadrupled hamstring autograft in all patients. Infection after ACL surgery is has been reported between 1.2-2.6%[25,26]. Our infection rate was very high in charity theatre setup and further surgeries were stopped. All patient had superficial infection only. Infection rate in private setup was nil (n=12). At final follow up all our patients had stable knee except one, with associated LCL injury. This was missed on first MRI. Examination under anaesthesia revealed laxity on varus stress test compared to other side and negative dial test. We could not perform repair of LCL because of no consent and only ACL Reconstruction was done. Repeat MRI at 4 months, revealed good anatomical position of ACL with LCL injury. Patient was offered LCL repair but he refused. He has no sporting activities and work as motor mechanic. So he is managing himself with non-operative treatment of LCL injury. Graft failure rate is variable and range from (0.7-20%).[27,28,29]The literature reports that a large proportionof graft failures occur within the first 2 years after surgery.[13,28]We did not had any graft failure at two year mark.

Return to normal activities was achieved in all patients. One patient was unable to return to his sports activity due to associated cartilage damage confirmed on arthroscopy. We used both adjustable-length and fix-loop CSF devices for fixation of graft. Both had comparable outcomes. Detailed analysis is beyond the scope of this study.In this study, postoperative instability and failure rates were low compared with other studies.[5,12,18,21,26] Postoperative laxity also remained stable at 6 months after surgery, while clinical result continued to improve as reported by patients at subsequent follow-ups. This suggests that the surgical technique and devices used in this study offers stable graft fixation and prevents lengthening of graft at later stage.

CONCLUSION

At 2 years, outcome of ACL reconstruction performed by one surgeon using same surgical technique with adjustable CSF device and absorbable tibial screw granted satisfactory clinical results in all patients. No graft failure was recorded, only superficial infection occurred in four patients was reported. Rehabilitation played an important role in return to activities of daily living in all patients at final follow up. ACL reconstruction techniques continues to evolve and the further studies to analyse long term outcomes, associated injuries and comparison between various devices, persists.

REFERENCES

1. Maletis GB, Chen J, Inacio MC, Funahashi TT. Age-related risk factors for revision anterior cruciate ligament reconstruction: a cohort study of 21,304 patients from the Kaiser Permanente Anterior Cruciate Ligament Registry. Am J Sports Med. 2016;44:331-336.
2. Gifstad T, Sole A, Strand T, Uppheim G, Grøntvedt T, Drogset JO. Long-term follow-up of patellar tendon grafts or hamstring tendon grafts in endoscopic ACL reconstructions. Knee Surg Sports TraumatolArthrosc. 2013;21:576-583.
3. Maletis GB, Inacio MC, Funahashi TT. Risk factors associated with revision and contralateral anterior cruciate ligament reconstructions in the Kaiser Permanente ACLR registry. Am J Sports Med. 2015;43: 641-647
4. Smigielski R, Zdanowicz U, Drwiega M, Ciszek B, Williams A. The anatomy of the anterior cruciate ligament and its relevance to the technique of reconstruction. Bone Joint J. 2016;98-B(8):1020-1026.
5. Sonnery-Cottet B, Saithna A, Cavalier M, et al. Anterolateral ligament reconstruction is associated with significantly reduced ACL graft rupture rates at a minimum follow-up of 2 years: a prospective comparative study of 502 patients from the SANTI study group. Am J Sports Med. 2017;45(7):1547-1557
6. Colombet P, Graveleau N, Jambou S. Incorporation of hamstring grafts within the tibial tunnel after anterior cruciate ligament reconstruction: magnetic resonance imaging of suspensory fixation versus interference screws. Am J Sports Med. 2016;44(11):2838-2845.
7. Persson A, Kjellsen AB, Fjeldsgaard K, Engebretsen L, Espehaug B, Fevang JM. Registry data highlight increased revision rates for endobutton/biosure HA in ACL reconstruction with hamstring tendon autograft: a nationwide cohort study from the Norwegian Knee Ligament Registry, 2004-2013. Am J Sports Med. 2015;43(9):2182-2188.
8. Watson JN, McQueen P, Kim W, Hutchinson MR. Bioabsorbable interference screw failure in anterior cruciate ligament reconstruction: a case series and review of the literature. Knee. 2015;22(3): 256-261.
9. Mermerkaya MU, Atay OA, Kaymaz B, Bekmez S, Karaaslan F, Doral MN. Anterior cruciate ligament reconstruction using a hamstring graft: a retrospective comparison of tunnel widening upon use of two different femoral fixation methods. Knee Surg Sports TraumatolArthrosc. 2015;23(8):2283-2291.
10. Ntagiopoulos PG, Demey G, Tavernier T, Dejour D. Comparison of resorption and remodeling of bioabsorbable interference screws in anterior cruciate ligament reconstruction. IntOrthop. 2015;39(4): 697-706.
11. Schurz M, Tiefenboeck TM, Winnisch M, et al. Clinical and functional outcome of all-inside anterior cruciate ligament reconstruction at a minimum of 2 years' follow-up. Arthroscopy. 2016;32(2):332-337.
12. Colombet P, Bouguennec N. Suspensory fixation device for use with bone-patellar tendon-bone grafts. Arthrosc Tech. 2017;6(3): e833-e838.
13. Colombet P, Graveleau N, Jambou S. Incorporation of hamstring grafts within the tibial tunnel after anterior cruciate ligament reconstruction: magnetic resonance imaging of suspensory fixation versus interference screws. Am J Sports Med. 2016;44(11):2838-2845.
14. Nye DD, Mitchell WR, Liu W, Ostrander RV. Biomechanical comparison of fixed-loop and adjustable-loop cortical suspensory devices for metaphyseal femoral-sided soft tissue graft fixation in anatomic anterior cruciate ligament reconstruction using a porcine model. Arthroscopy. 2017; 33(6):1225-1232.
15. Persson A, Gifstad T, Lind M, et al. Graft fixation influences revision risk after ACL reconstruction with hamstring tendon autografts. ActaOrthop. 2018;89(2):204-210.
16. Basson B, Philippot R, Neri T, Meucci JF, Boyer B, Farizon F. The effect of femoral tunnel widening on one-year clinical outcome after anterior cruciate ligament reconstruction using ZipLoop(R) technology for fixation in the cortical bone of the femur. Knee. 2016;23(2): 233-236.
17. Bressy G, Brun V, Ferrier A, et al. Lack of stability at more than 12 months of follow-up after anterior cruciate ligament reconstruction using all-inside quadruple-stranded semitendinosus graft with adjustable cortical button fixation in both femoral and tibial sides. OrthopTraumatolSurg Res. 2016;102(7):867-872.
18. Choi NH, Yang BS, Victoroff BN. Clinical and radiological outcomes after hamstring anterior cruciate ligament reconstructions: comparison between fixed-loop and adjustable-loop cortical suspension devices. Am J Sports Med. 2017;45(4):826-831.
19. Schurz M, Tiefenboeck TM, Winnisch M, et al. Clinical and functional outcome of all-inside anterior cruciate ligament reconstruction at a minimum of 2 years' follow-up. Arthroscopy. 2016;32(2):332-337.
20. Yasen SK, Borton ZM, Eyre-Brook AI, et al. Clinical outcomes of anatomic, all-inside, anterior cruciate ligament (ACL) reconstruction. Knee. 2017;24(1):55-62.
21. Philippe Colombet , Mo Saffarini , Nicolas Bouguennec. Clinical and Functional Outcomes of Anterior Cruciate Ligament Reconstruction at a Minimum of 2 Years Using Adjustable Suspensory Fixation in Both the Femur and Tibia: A Prospective Study. Orthop J Sports Med 2018 Oct 22; 6(10)
22. Colombet P, Graveleau N. An anterior cruciate ligament reconstruction technique with 4-strand semitendinosus grafts, using outside-in tibial tunnel drilling and suspensory fixation devices. Arthrosc Tech. 2015; 4(5)
23. Samuelsen BT, Webster KE, Johnson NR, Hewett TE, Krych AJ. Hamstringautograft versus patellar tendon autograft for ACL reconstruction:is there a difference in graft failure rate? A meta-analysis of47,613 patients. ClinOrthopRelat Res. 2017; 475(10):2459-2468.
24. Xie X, Liu X, Chen Z, Yu Y, Peng S, Li Q. A meta-analysis of bonepatellartendon-bone autograft versus four-strand hamstring tendonautograft for anterior cruciate ligament reconstruction. Knee. 2015; 22(2):100-110.
25. Ravi Gupta, Munish Sood,[1] Anubhav Malhotra, Gladson David Masih, MuktaRaghav, and Tanu Khanna. Incidence, Risk Factors, and Management of Infection Following Anterior Cruciate Ligament Reconstruction Surgery. Indian J Orthop. 2018; 52(4): 399–405.
26. Alberto Gobbi, Georgios Karnatzikos, SanyamChaurasia, Mudhigere Abhishek et al. Postoperative Infection After Anterior Cruciate Ligament Reconstruction. Sports Health. 2016 Mar; 8(2): 187–189.
27. Helito C, Sobrado M, Giglio P, Batista M, et al. Combined Reconstruction of the Anterolateral Ligament in Patients With Anterior Cruciate Ligament Injury and Ligamentous Hyperlaxity Leads to Better Clinical Stability and a Lower Failure Rate Than Isolated Anterior Cruciate Ligament Reconstruction. Arthroscopy 2019 Sep;35(9):2648-2654.
28. Di Benedetto P., Di Benedetto E., Fiocchi A., Beltrame A., Causero A. Causes of failure of anterior cruciate ligament reconstruction and revision surgical strategies. Knee SurgRelat Res. 2016;28:319–324.
29. Getgood A , Bryant D, Litchfield R , Heard M, et al. Lateral Extra-articular Tenodesis Reduces Failure of Hamstring Tendon Autograft Anterior Cruciate Ligament Reconstruction: 2-Year Outcomes From the STABILITY Study Randomized Clinical Trial. Am J Sports Med 2020 Feb; 48(2):285-297.